APPENDIX F

RECALCULATION PROCEDURE - CASE EXAMPLE FOR ALUMINUM

Power Station Ash Disposal Site

A state has granted an electric power company permission to construct and operate a site for the disposal of fly ash, bottom ash, construction debris, boiler refractory material, screenhouse debris, pyrites, insulation containing non-friable asbestos, wastewater lagoon sludges, coal pile sludges, spent filter materials, and spent resins, all of which are generated at a nearby power station. The disposal site, located approximately two miles from the power station, consists of an active area where waste material is currently being disposed, and a closed area containing waste material which has been covered with soil and planted for land reclamation.

The surface water runoff and leachate from the active area is collected in three sedimentation ponds before being discharged into Unnamed Tributary, approximately one-third mile upstream from its confluence with Bradley Run.

The active area of the disposal site contains three outfalls which are permitted as Outfalls 001, 002, and 003. The predominant characteristics which are common to each of these outfalls (and which are typical for fly ash effluents) are sulfates, TSS, aluminum, boron, iron, and manganese.

Description of the Receiving Streams

Unnamed Tributary is a first order stream which originates on the southern edge of the active area of the ash disposal site. Prior to construction of the ash disposal site, Unnamed Tributary flowed through what is now part of the disposal site. During construction, the upper portion of Unnamed Tributary was diverted to an area south of the site.

Unnamed Tributary is the receiving stream for effluent discharged from Outfalls 003, 004, and 005. All three effluents enter Unnamed Tributary via a small stream (also unnamed) at a point on Unnamed Tributary approximately one-third mile upstream from its confluence with Bradley Run. Except during years of very low flow, the discharges from the outfalls are continuous throughout the year, and as a result the flow of Unnamed Tributary is continuous throughout the year downstream of the outfalls. Upstream of the outfalls, however, the flow is intermittent during low flow periods. Unnamed Tributary is a high gradient stream downstream of the outfalls, dropping approximately 350 feet in elevation over the one-third of a mile segment to the confluence with Bradley Run. The state assigned a 7Q10 design flow for Unnamed Tributary of 0 cfs.

Existing Water Quality Standards

The effluent permit limits are based on state water quality standards for the categories: warm water fishery streams, small non-fishable streams, and wetlands. The state's chronic water quality criterion for aluminum is 0.087 mg/L.

The procedure used to recalculate the FAV for aluminum followed Appendix B of USEPA's *Interim Guidance for the Determination and Use of Water-Effect Ratios for Metals* (USEPA, 1994). The general approach to recalculating the FAV was to generate a list of species that have been found at the site, and to use this list in the process of deleting taxa from and/or adding taxa to the national data set. Appendix B of the USEPA guidance provides a straightforward step-wise process that describes the conditions necessary to add taxa to and/or delete taxa from the national data set. After the addition/deletion process is completed, the FAV is recalculated using the revised data set.

Procedure

The step-wise process of adding taxa to and/or deleting taxa from the national toxicity data set required the generation of a list of species that could occur at the site. This list was created using data gathered from ecological surveys conducted by a local university during 1988 through 1995 for Unnamed Tributary, Bradley Run, and a reference stream within the same watershed similar in size to Unnamed Tributary. The surveys primarily consisted of collecting and identifying organisms from the benthic community at multiple stations in each of the three streams in May and in August each year. A fish survey was conducted by the university in October 1995. The organisms recorded for Unnamed Tributary and the reference stream were included in this evaluation because they represent the organisms, which could occur at the site. Bradley Run and its fauna were included in the aluminum recalculation of the FAV because doing so would serve to protect the downstream uses of the receiving streams. The list of taxa that could occur at the site are given in Table 1.

The guidance for performing the Recalculation Procedure, as given in Appendix B of the *Interim Guidance on the Determination and Use of Water-Effect Ratios for Metals* (USEPA, 1994), requires that approved corrections and additions to the data set be included in the recalculation. Communication with USEPA headquarters at the time of this study indicated that there were no corrections or additions to the national data set for aluminum, and therefore the current national data set is consistent with Table 3 of USEPA's AWQC document for aluminum. Table 2 presents the taxa contained in the national data set for aluminum in phylogenetic order. The circled taxa in Table 2 represent the taxa that could occur at the site, and therefore are retained in the national data set. Each taxon was evaluated according to the deletion process procedures described in USEPA's guidance; and the results are as follows:

Taxa	***Deletion Status with Explanation***
Dugesia tierias (planarian)	**Retain**. The genus *Phygocata* from the family, Planaridae, occurs in Fly Ash Run, Unnamed Tributary and Daugherty Run.
Physa sp. (snail)	**Retain**. The genus *Lymnaea* from the order, Pulmonata, occurs in Unnamed Tributary.
Ceriodaphnia sp.	**Delete**. The genus and family do not occur at the site. The order, Cladocera, occurs at the site but is represented in the data set by *Gammarus pseudolimnaeus*.
Ceriodaphnia dubia	**Delete**. The genus and family do not occur at the site. The order, Cladocera, occurs at the site but is represented in the data set by *Gammarus pseudolimnaeus*.
Daphnia magna	**Delete**. The genus and family do not occur at the site. The order, Cladocera, occurs at the site but is represented in the data set by *Gammarus pseudolimnaeus*.
Gammarus pseudolimnaeus (scud)	**Retain**. The family Gammaridae occurs in Fly Ash Run and the genus *Crangonyx* from the family Gammaridae occurs in Daugherty Run.
Tanytarsus dissimilis (midge)	**Retain**. The Tanytarsini tribe from the family Chironomidae occurs in Fly Ash Run, Unnamed Tributary, and Daugherty Run.
Oncorhynchus tshawytsha (chinook salmon)	**Delete**. The genus and family do not occur at the site. The order, Salmoniformes, occurs at the site but is represented in the data set by *Salvelinus fontinalis* (brook trout).

Taxa	*Deletion Status with Explanation*
Oncorhynchus mykiss (rainbow trout)	**Retain**. The occurrence of rainbow trout in Bradley Run is not known at this time. However, if rainbow trout occur in the river receiving Bradley Run either through a stocking program or through natural reproducing populations, they may periodically enter Bradley Run.
Salvelinus fontinalis (brook trout)	**Retain**. This species, *Salvelinus fontinalis*, occurs in Bradley Run.
Pimephales promelas (fathead minnow)	**Retain**. The species *Rhinichthys atratulus* (blacknose dace) and *R. cataractae* (longnose dace) from the family Cyprinidae occurs in Bradley Run.
Ictalurus punctatus (channel catfish)	**Retain**. The occurrence of channel catfish in Bradley Run has not been recorded. However, the habitat is suitable for some madtom and bullhead species, which are members of the family Ictaluridae and therefore could occur at the site.
Lepomis cyanellus (green sunfish)	**Retain**. The occurrence of the green sunfish in Bradley Run has not been recorded. However, the habitat is suitable for this common species and therefore it could occur at the site.
Perca flavescens (yellow perch)	**Retain**. The genus and family do not occur at the site. The order, Perciformes, does occur at the site as represented by *Cottus bairdi* (mottled sculpin), but this order is not represented in the data set.

Recalculation of Final Acute Value

The computer program provided in USEPA's *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (USEPA, 1985) was used to recalculate the FAV for aluminum using the revised data set. Four taxa, representing three GMAVs were deleted from the data set, namely, *Ceriodaphnia*, *Daphnia magna* and *Oncorhynchus tshawytsha*. The revised data set therefore had 11 GMAVs, and the four most sensitive GMAVs were used in the recalculation. A representation of the output from the computer program is as follows:

HOW MANY GMAVS ARE IN THE DATA SET?
? 11
WHAT ARE THE FOUR LOWEST GMAVS?
? 22600 (*Acroneuria sp*.)
? 22000 (*Gammarus pseudolimnaeus*)
? 10390 (rainbow trout)
? 3600 (brook trout)
FAV = 2533

The FAV for the entire national data set is 1,496 µg/L. The recalculated FAV is 2,533 µg/L, an increase in the FAV by a factor of 1.693. The chronic criterion was recalculated by multiplying the relative difference in the site-specific data set and the national data set (1.693) by the chronic criterion, 0.087 mg/L, to obtain 0.1473 mg/L.

TABLE 1. List of Taxa Collected from Bradley Run, a Reference Stream and Unnamed Tributary 1988 through 1995

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Turbellaria: *Phygocata velata*		x	
Turbellaria: *Phygocata c.f. morganii*	x	x	x
Nematoda	x	x	
Oligocheata		x	
Oligochaeta: *Branchiobdella sp*.	x	x	
Oligochaeta: Aeolosomatidae	x		
Oligochaeta: Haplotaxidae	x		
Oligochaeta: Lumbriculidae	x	x	x
Oligochaeta: *Eclipidrilus sp.*	x	x	x
Oligochaeta: Tubificidae	x	x	x
Oligochaeta: Naididae	x	x	x
Gastropoda: *Lymnaea sp.*			x
Crustacea: *Asellus sp.*		x	
Crustacea: *Asellus kenki*		x	
Crustacea: *Caecidotea sp.*	x		
Crustacea: Gammaridae		x	
Crustacea: *Crangonyx sp.*	x		
Crustacea: Copepoda		x	
Crustacea: *Cambarus sp.*	x	x	x
Collembola		x	x
Ephemeroptera: *Baetisca carolina*	x		
Ephemeroptera: *Pseudocleon sp.*	x	x	x
Ephemeroptera: *Baetis sp.*	x	x	x
Ephemeroptera: *Baetis brunneicolor*	x		
Ephemeroptera: *Baetis amplus*	x		x
Ephemeroptera: *Seratella sp.*	x		
Ephemeroptera: *Ephemerella subvaria*	x		x

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Ephemeroptera: *Ephemerella dorothea*	x		
Ephemeroptera: *Ephemerella invaria*	x		
Ephemeroptera: *Ephemerella sp.*	x		
Ephemeroptera: *Eurylophella sp.*	x		
Ephemeroptera: *Cinygmula subequalis*	x		x
Ephemeroptera: *Cinygmula sp.*			
Ephemeroptera: *Ephemera guttulata*	x		
Ephemeroptera: *Ephemera simulans*	x		
Ephemeroptera: *Ephemera sp.*	x		
Ephemeroptera: *Isonychia sp.*	x		
Ephemeroptera: Leptoplebiidae	x	x	
Ephemeroptera: *Paraleptophlebia sp.*	x	x	
Ephemeroptera: *Drunella sp.*	x		
Ephemeroptera: *Drunella lata*	x		
Ephemeroptera: *Epeorus pluralis*	x		
Ephemeroptera: *Epeorus rubidius*	x		
Ephemeroptera: *Epeorus sp.*	x		x
Ephemeroptera: Heptageniidae		x	x
Ephemeroptera: *Stenonema sp.*	x		
Ephemeroptera: *Stenonema vicarium*	x		
Ephemeroptera: *Stenonema femoratum*	x		
Ephemeroptera: *Stenonema modestum*			x
Ephemeroptera: *Nixe sp*.		x	
Plecoptera: Capniidae	x	x	x
Plecoptera: Chloroperlidae	x		
Plecoptera: Leuctridae	x	x	
Plecoptera: *Leuctra sp*.		x	
Plecoptera: *Paraleuctra sp*.	x	x	x
Plecoptera: Nemouridae		x	x

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Plecoptera: *Amphinemoura nigritta*		x	
Plecoptera: *Amphinemoura delosa*	x	x	x
Plecoptera: *Amphinemoura wui*		x	x
Plecoptera: *Yugus arinus*			x
Plecoptera: *Pteronarcys proteus*	x		x
Plecoptera: *Haloperla sp.*	x		x
Plecoptera: *Talloperla sp*.	x	x	x
Plecoptera: *Acroneuria sp.*	x		x
Plecoptera: *Acroneuria abnormis*	x		x
Plecoptera: *Acroneuria caroliniensis*	x		x
Plecoptera: *Beloneuria sp.*		x	
Plecoptera: *Paragentina sp.*	x		
Plecoptera: *Cultus sp.*	x	x	
Plecoptera: *Isoperla sp.*	x	x	
Hemiptera: *Microvelia sp.*	x	x	x
Hemiptera: *Rhagovelia sp.*	x		
Hemiptera: *Trepobates sp.*		x	
Megaloptera: *Nigronia fasciatus*	x	x	x
Megaloptera: *Nigronia serricornis*	x		x
Megaloptera: *Cordulegaster sp.*		x	
Megaloptera: *Sialis latreille*	x	x	x
Trichoptera: *Glossoma sp.*	x		
Trichoptera: Hydropsychidae	x	x	x
Trichoptera: *Diplectrona modesta*	x	x	x
Trichoptera: *Neophylax mitchelli*	x	x	
Trichoptera: *Cheumatopsyche sp.*	x		
Trichoptera: *Hydropsyche sp.*	x		x
Trichoptera: *Hydropsyche betteni*	x	x	x
Trichoptera: *Symphitopsyche alhedra*	x		

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Trichoptera: *Symphitopsyche bifida*	x		
Trichoptera: *Symphitopsyche slossonae*	x	x	x
Trichoptera: *Symphitopsyche riola*	x		x
Trichoptera: *Symphitopsyche etnieri*	x		
Trichoptera: *Symphitopsyche morosa*	x		
Trichoptera: *Symphitopsyche sparna*	x		
Trichoptera: *Symphitopsyche sp.*	x		x
Trichoptera: *Hydatophylax sp.*		x	
Trichoptera: *Cernotina sp.*		x	x
Trichoptera: *Micrasma sp.*	x		
Trichoptera: *Cyrnellus sp.*			x
Trichoptera: *Chimera sp.*	x		
Trichoptera: *Dolophiloides sp.*	x	x	x
Trichoptera: *Oligostomis sp.*		x	
Trichoptera: *Goera sp.*	x		x
Trichoptera: Rhyacophilidae		x	
Trichoptera: *Rhyacophila nigrita*		x	
Trichoptera: *Rhyacophila sp.*	x	x	x
Trichoptera: *Rhyacophila fuscula*	x		x
Trichoptera: *Lype diversa*	x		x
Trichoptera: *Psychomyia sp.*	x		
Trichoptera: *Scatobiellia sp.*	x		
Trichoptera: *Hydroptila sp.*	x	x	
Trichoptera: *Lepidostoma sp.*	x	x	x
Trichoptera: *Pycnopsyche divergens*		x	
Trichoptera: *Pycnopsyche guttifer*		x	
Trichoptera: *Pycnopsyche scabripennis*			x
Trichoptera: Philipotamidae		x	
Trichoptera: *Wormaldia sp.*		x	x

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Trichoptera: *Polycentropus sensu lato*	x	x	x
Trichoptera: *Polycentropus sp.*	x	x	
Coleoptera: *Ilybius sp.*		x	
Coleoptera: *Liodessus/Uvarus sp.*		x	
Coleoptera: *Agabus sp.*			x
Coleoptera: *Pyrrhalta sp.*		x	
Coleoptera: Curculionidae		x	
Coleoptera: *Hydrobiomorpha sp.*		x	
Coleoptera: *Bagous sp.*			x
Coleoptera: *Helophorus sp.*		x	
Coleoptera: *Helichus sp.*	x		
Coleoptera: *Ouliminus sp.*	x		
Coleoptera: *Promoresia sp.*	x		
Coleoptera: *Optioservus sp.*	x	x	
Coleoptera: *Dubiraphia sp.*	x		
Coleoptera: *Stenelmis sp.*		x	
Coleoptera: Hydrophilidae		x	x
Coleoptera: Melyridae		x	
Coleoptera: *Ectopria sp.*	x	x	x
Coleoptera: *Psephenus herricki*	x	x	
Coleoptera: *Stenus sp.*	x	x	
Lepidoptera: *Vogita sp.*		x	
Diptera: *Blephericera sp.*	x		x
Diptera: *Probezzia sp.*			x
Diptera: Dolichopodidae	x		
Diptera: Cecidomyiidae		x	
Diptera: *Athrix sp.*	x		
Diptera: *Bezzia sp.* group	x	x	x
Diptera: *Atrichopogon sp.*	x	x	

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Diptera: Chironomidae	x	x	x
Diptera: Chironominae	x	x	x
Diptera: Tanytarsini	x	x	x
Diptera: Orthocladinae	x	x	x
Diptera: Tanypodinae	x	x	x
Diptera: Empididae			x
Diptera: *Wiedemannia sp.*			x
Diptera: Simuliidae	x	x	
Diptera: *Prosimulium sp.*	x		
Diptera: *Simulium sp.*	x		
Diptera: *Simulium notiale*		x	
Diptera: *Simulium tuberosum* group	x	x	x
Diptera: *Stratiomys sp.*			x
Diptera: *Chelifera sp.*	x	x	
Diptera: *Chrysops sp.*	x	x	x
Diptera: *Ormosia sp.*	x	x	x
Diptera: *Dicranota sp.*	x	x	x
Diptera: *Hemerodromia sp.*	x	x	x
Diptera: *Oreogeton sp.*		x	
Diptera: *Antocha sp.*			x
Diptera: *Tipula sp.*	x	x	x
Diptera: *Tipula abdominalis*			x
Diptera: *Pedicia sp.*		x	x
Diptera: *Hexatoma sp.*	x	x	x
Diptera: *Molophilus sp.*	x	x	x
Diptera: *Pseudolimnophila sp.*	x	x	x
Diptera: Sciomyzidae		x	
Salmoniformes: *Salvelinus fontinalis* (Brook trout)	x		
Cypriniformes: *Rhinichthys atratulus* (Blacknose dace)	x		

TAXA	Bradley Run	Reference Stream	Unnamed Tributary
Cypriniformes: *Rhinichthys cataractae* (Longnose dace)	x		
Perciformes: *Cottus bairdi* (Mottled sculpin)	x		

TABLE 2. LIST OF TAXA IN THE NATIONAL DATA SET FOR ALUMINUM AND THEIR STATUS FOR THE RECALCULATION OF THE FINAL ACUTE VALUE

Phylum	Class	Order	Family	Genus	Species	Recalculation status	GMAV[a], µg/L
Platyhelminthes	Turbellaria	Tricladida	Planariidae	*Dugesia*	*D. tierias*	Retain	>23,000
Mollusca	Gastropoda	Pulmonata	Physidae	*Physa*		Retain	30,600
Arthropoda	Crustacea	Cladocera	Daphnidae	*Ceriodaphia*		Delete	2,640
Arthropoda	Crustacea	Cladocera	Daphnidae	*Ceriodaphia*	*C. dubia*	Delete	
Arthropoda	Crustacea	Cladocera	Daphnidae	*Daphnia*	*D. magna*	Delete	38,200
Arthropoda	Crustacea	Amphipoda	Gammaridae	*Gammarus*	*G. pseudolimnaeus*	Retain	22,000
Arthropoda	Insecta	Plecoptera	Perlidae	*Acroneuria*		Retain	>22,600
Arthropoda	Insecta	Diptera	Chironomidae	*Tanytarsus*	*T. dissimilis*	Retain	>79,000
Chordata	Osteichthyes	Salmoniformes	Salmonidae	*Oncorhynchus*	*O. tshawytscha*	Delete	>40,000
Chordata	Osteichthyes	Salmoniformes	Salmonidae	*Oncorhynchus*	*O. mykiss*	Retain	10,390
Chordata	Osteichthyes	Salmoniformes	Salmonidae	*Salvelinus*	*S. fontinalis*	Retain	3,600
Chordata	Osteichthyes	Cypriniformes	Cyprinidae	*Pimephales*	*P. promelas*	Retain	35,000
Chordata	Osteichthyes	Siluriformes	Ictaluridae[b]	*Ictalurus*	*I. punctatus*	Retain	>47,900
Chordata	Osteichthyes	Perciformes	Centrarchidae	*Lepomis*	*L. cyanellus*[c]	Retain	>50,000
Chordata	Osteichthyes	Perciformes	Percidae	*Perca*	*P. flavescens*	Retain	>49,000

[a] Genus mean acute value.
[b] Family not recorded, but habitat is suitable for members of this family to occur at site.
[c] Species not recorded, but habitat is suitable for species to occur at site.

Estimated Costs to Conduct a Recalculation Procedure Study

The activities needed to perform the recalculation procedure consist of 1) a visit to the site to become familiar with the relevant characteristics; 2) preparation of a study plan; 3) data acquisition; 4) recalculation; 5) report preparation; and 6) follow-up interaction with stake-holders and regulatory agencies. The costs to perform all of the above steps with the exception of step 3, data acquisition, can range from $7,500 to over $10,000 depending on the complexity of the site and the amount of follow-up activities. The costs for data acquisition are dependent upon whether existing data are available for the site and reference condition for the site. If the appropriate data are available, the acquisition of data from the sources may only add a nominal amount to the total costs for the study. If data are not available, field studies will need to be conducted that survey multiple assemblages over different seasons at both the site of interest and at least one reference condition to adequately list the organisms that "occur at the site." The latter effort can add $10,000 to over $50,000 to the study, with the lower estimate for a smaller site consisting of wadeable streams and the higher end for larger sites containing water bodies requiring boats for collecting the organisms.